FORM PTO-1390 (REV 10-94)

U S DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE

TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371

DOCKET #: 4478-6PUS

				U.S. APPLICATION NO. (If known, see 37 CFR 1.5)
				09/807678

INTERNATIONAL APPLICATION NO	INTERNATIONAL FILING DATE	PRIORITY DATE CLAIMED
PCT/EP99/07849	**October 15, 1999**	**October 15, 1998**

TITLE OF INVENTION

Transmitter-Receiver for Data Signals, System for Transmitting Data Signals, Device for Assembly in a Transmitter-Receiver and Synchronization Method

APPLICANT(S) FOR DO/EO/US

Jürgen KONRAD

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. [x]This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. [] This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371
3. [x]This express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(1).
4. [x]A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.
5. [x]A copy of the International Application as filed (35 U.S.C. 371(c)(2))
   a. [x] is transmitted herewith (required only if not transmitted by the International Bureau).
   b. [] has been transmitted by the International Bureau.
   c. [] is not required, as the application was filed in the United States Receiving Office (RO/US)
6. [x]A translation of the International Application into English (35 U.S.C. 371(c)(2)).
7. [x]Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3))
   a. [] are transmitted herewith (required only if not transmitted by the International Bureau).
   b. [] have been transmitted by the International Bureau.
   c. [] have not been made; however, the time limit for making such amendments has NOT expired.
   d. [x]have not been made and will not be made.
8. [] A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
9. [x]An unexecuted oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).
10. [x]A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

Items 11. to 16. Below concern other document(s) or information included:

11. [] An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
12. [] An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
13. [x]A **FIRST** preliminary amendment.
    [] A **SECOND** or **SUBSEQUENT** preliminary amendment.
14. [] A substitute specification.
15. [] A change of power of attorney and/or address letter.
16. [x]Other items or information *(specify):* PCT Publication Sheet, Int'l Preliminary Examination Report, Int'l Search Report, PCT Request

U.S. APPLICATION NO. (If known, see 37 C.F.R. 1.5) 09/807678	INTERNATIONAL APPLICATION NO. PCT/EP99/07849	ATTORNEY'S DOCKET NUMBER 4478-6PUS

17.[x]The following fees are submitted:

Basic National Fee (37 CFR 1.492(a)(1)-(5)):
Search Report has been prepared by the EPO or JPO **$860.00**
International preliminary examination fee paid to USPTO (37 CFR 1.482)..... **$690.00**
No international preliminary examination fee paid to USPTO (37 CFR 1.482)
but international search fee paid to USPTO (37 CFR 1.445(a)(2)) **$710.00**
Neither international preliminary examination fee (37 CFR 1.482)
nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO **$1000.00**
International preliminary examination fee paid to USPTO (37 CFR 1.482)
and all claims satisfied provisions of PCT Article 33(2)-(4) **$100.00**

			ENTER APPROPRIATE BASIC FEE AMOUNT =	$	860.00
Surcharge of **$130.00** for furnishing the oath or declaration later than [] 20 [] 30 months from the earliest claimed priority date (37 CFR 1.492(e)).				$	
Claims	Number Filed	Number Extra	Rate		
Total Claims	8 - 20 =	0	x **$18.00**	$	
Independent Claims	4 - 3 =	1	x **$80.00**	$	80.00
Multiple dependent claim(s) (if applicable)			+ **$270.00**	$	
			TOTAL OF ABOVE CALCULATIONS =	$	940.00
Reduction of ½ for filing by small entity, if applicable.				$	
			SUBTOTAL =	$	940.00
Processing fee of **$130.00** for furnishing the English translation later than [] 20 [] 30 months from the earliest claimed priority date (37 CFR 1.492(f)). +				$	
			TOTAL NATIONAL FEE =	$	940.00
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by the appropriate cover sheet (37 CFR 3.28, 3.31). **$40.00** per property +				$	
			TOTAL FEES ENCLOSED		$940.00
			Amount to be refunded:		$
			charged:		$

a. [x]One check(s) in the amount(s) of $940.00 and to cover the above fees is enclosed.
b. [] Please charge my Deposit Account No. 03-2412 in the amount of $____ to cover the above fees. A duplicate copy of this sheet is enclosed.
c. [x]The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 03-2412. A duplicate copy of this sheet is enclosed.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

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By Express Mail # EL834972792US · April 16, 2001

Attorney Docket # 4478-6PUS

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re National Phase PCT Application of

Jürgen KONRAD

International Appln. No.: PCT/EP99/07849

International Filing Date: October 15, 1999

For: Transmitter-Receiver for Data Signals, System for Transmitting Data Signals, Device for Assembly in a Transmitter-Receiver and Synchronization Method

PRELIMINARY AMENDMENT

Assistant Commissioner for Patents
Washington, D.C. 20231
BOX PCT

S I R:

Prior to examination of the above-identified application please amend the application as follows:

In the Specification:

On Page 1, after line 2, insert the following heading:

--BACKGROUND OF THE INVENTION

1. Field of the Invention--

On page 1, after line 4, insert the following heading:

--2. Description of the Prior Art--

On page 2, after line 26, insert the following:

--3. Summary of the Invention--

On page 2, replace the paragraphs starting on lines 27 and 31 with the following:

An object of the present invention is to provide an apparatus which permits safe data transfer with simple means along with fast and simple synchronization of transmitter and receiver. A further object is to provide a simple and reliable synchronization method.

The object of the invention is met by a transceiver for data signals that has the following features:

a transmitting section which conditions input data for transmission over a communication link containing a plurality of channels,

a receiving station which receives signals from one of the channels and processes them into output data,

a channel switching device connected to the transmitting section and the receiving section,

a channel hopping program part in which a plurality of predetermined channel hopping sequences are programmed, a predetermined channel hopping sequence being associated with the transceiver as an address,

a channel selecting device which controls the channel switching device in accordance with a predetermined channel hopping sequence, and

a clock device for operating the channel selecting device, the clock device being synchronized by a public time signal (radio clock) to synchronize channel hopping between a transmitting and a receiving transceiver with the aid of the public time signal.

On page 4, replace the paragraph beginning on line 8 with the following:

The receiver called by a transmitting device confirms the calling and the transmitting device synchronizes itself with the receiver. Since only said two devices work in synchronism in the channel hopping sequence specific to this connection and stay only in the particular channel for only a relatively short time, one obtains protection for the transferred data signals, on the one hand, and prevents a stronger signal from being able to terminate the connection, on the other hand.

On page 5, replace the paragraph beginning on line 22 with the following:

The invention furthermore provides a method for synchronizing transceiving operation between a transmitter and a receiver which are connected over a communication link with cyclically hopping channels, comprising the following steps:

the transmitter *(A)* calls a desired receiver *(B)*,

the same channel hopping sequence is adjusted in the transmitter *(A)* and the receiver *(B)*,

transmitter *(A)* and receiver *(B)* both receive a public time signal,

transmitter and receiver are synchronized by the time signal or a signal derived therefrom by the channel hopping cycle being started on a previously defined channel in synchronism with the time signal both in the transmitter and the receiver.

On page 6, before the first line insert the following heading:

--BRIEF DESCRIPTION OF THE DRAWINGS--;

On page 6, replace the paragraph beginning on line 1 with the following:

In the drawings, wherein like reference characters denote similar elements throughout the several views:

FIG. 1 is a block diagram of a transceiver with a device executed as an additional device for automatic and continuous hopping of transmission channels;

FIGS. 2a and 2b are timing diagrams showing the setup of a connection between two transceivers;

FIGS. 3a and 3b are flow charts showing the operation of a transmitter and receiver in accordance with the invention;

FIG. 4 is a functional block diagram of a channel selecting device; and

FIG. 5 is a block diagram of an embodiment of an additional part of a transceiver shown in FIG. 1 at the bottom right.

On page 6, after line 10 insert the following heading:

--DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS--

On page 6, replace the paragraph beginning on line 11 as follows:

As indicated in FIG. 1, the transceiver contains a radio data transmission device 2 known in the art which is equipped with an inventive additional part 1 for protecting the transfer of the data signals. The additional part 1 forms a data transfer device suitable for installation in any devices used for data transfer.

On page 6, replace the paragraph starting on line 19 as follows:

Departing from the representation in FIG. 1, additional part 1 may also be integrated in transceiver 2.

On page 6, replace the paragraph beginning on line 21 with the following:

A data signal source 4, for example an audio frequency part connected to a microphone, provides data signals to a signal conditioning circuit 6 via a channel switch 10. Signal conditioning circuit 6 modulates the data signals to condition them for radiation through an antenna 8. In customary transceivers, the channel switch 10 is formed as a manual selector switch for selecting one of the available channels. Reception of data is effected similarly to transmission of data. The receive signals coming through the antenna 8 are demodulated, amplified, etc., in a signal conditioning circuit 12 and then fed via the channel switch 10 to a data signal sink 14, shown in general form here, having loudspeaker 16 connected thereto for example. The details of the device generally described here are known from the prior art and shall not be explained more closely.

On page 6, replace the paragraph beginning on line 31 with the following:

Additional part 1 shown on the bottom right in FIG. 1 is used for fast and continuous change-over of the particular "active" channel in channel switch 10. For this purpose, the channel switch 10 has connected thereto a channel selecting device 20 which is in turn driven by a channel hopping sequence program part 22 which contains a processor and a memory.

On page 7, replace the paragraph starting on line 4 as follows:

Time synchronization of a transmitting and a receiving device is effected with the aid of a clock device containing a time signal generator 24 and a clock 26. For this purpose, the time signal generator 24 receives a public time signal (the signal DCF 77 in Germany) though an antenna 25 and forms therefrom a second clock signal *s* and a minute clock signal *m*. The second clock signal *s* is fed to the clock 26 which generates in synchronism with the second clock signal *s* a fast pulse train, in the present case a pulse train with a frequency of one megahertz.

On page 7, replace the paragraph starting on line 11 as follows:

In the program part 22 for the channel hopping sequence a plurality of channel hopping sequences are stored.

On page 7, replace the paragraph starting on line 15 as follows:

When one user of the CB radio system wants to speak to another user with a transceiver of the kind shown in FIG. 1, he enters the receiver's identification number via a keyboard not shown. A corresponding code goes via the signal source 4 and the channel switch 10 into the signal conditioning circuit 6. The receiver called, which has the same components as the radio data transmission device 2 shown in FIG. 1, is in the standby state, thus receiving through its own antenna 8 the calling signal which is processed via the signal conditioning circuit 12 and channel switch 10 so that the call is then recognized.

On page 7, replace the paragraph starting on line 22 as follows:

The calling operation causes the channel hopping sequence belonging to the selected identification number to be adjusted in the transmitting device. In order to be able to communicate with the called receiver the transmitter must synchronize itself with the receiver. This is done with the aid of the time signal generator 24 which provides synchronous minute and second signals in all devices. For example, a certain data word is fed to the channel selection circuit 20 in the transmitting device by the program part 22, the data word being a channel hopping sequence specific to the identification number. Furthermore, the channel where synchronization is to begin is fixed in advance. At the following minute clock signal the channel where synchronization is to begin is held for a short time period by corresponding circuit-technology measures in the devices. After this time period has expired, the transmitter and the receiver work with a synchronous, identical channel hopping sequence. The clock 26 can feed a high-frequency signal (one megahertz) to the channel selection circuit 20 which then

feeds a corresponding control signal to the channel switch 10. The data are then changed over between the different channels in identical fashion both in the transmitter and in the receiver. Since only the transmitter and receiver work in synchronism with this specific channel hopping sequence, all other devices are excluded from communication.

On page 8, replace the paragraph starting on line 7 as follows:

The channel selection circuit 20 may be for example a register in which a certain pattern identifying the selected channel is stored at each clock. The content of the shift register may be deposited in a memory (EPROM). However, it is also possible to determine the channel hopping sequence on the basis of an algorithm, said algorithm processing the identification number into the channel hopping sequence.

On page 8, replace the paragraph starting on line 12 as follows:

FIGS. 2a and 2b shows the simplified case of a system with five channels 1, 2 ... 5 and a clock cycle comprising four clocks. FIG. 2a shows cyclical hopping of channels 1, 3, 5, 2, 1, 3, 5 ... of device 1 called by device 2, i.e., device 1 is the receiver and device 2 is the transmitter. The call by the transmitter 2 causes the channel sequence of the transmitter 2 to be replaced at that moment by that of the receiver 1 and a "start signal" for synchronization to be adjusted, channel "3" here. When these adjustments are finished, the transmitter 2 waits for the next agreed time clock, e.g. the second clock of the public time signal. When said second clock, t2, comes, the channel hopping sequence begins in the transmitter 2.

On page 8, replace the paragraph starting on line 20 as follows:

The transmitter 2 and receiver 1 are now working fully identically, in terms of channel selection. Accordingly, the two devices can also open a "window" for other data devices. For this purpose a defined channel is e.g. held for several seconds, e.g. in synchronism with the minute clock. In this time other users can dial in. At the end of the "window" all user devices begin to work with identical synchronous channel hopping sequences. Opening the "window", i.e. holding a certain channel in a time interval lasting e.g. a few seconds, can be effected with a special button.

On page 8, replace the paragraph starting on line 27 as follows:

All circuit parts described above and shown in the drawing can be produced with commercial components in the way known to one skilled in the art of data transmission in communication devices. The additional part 1 in FIG. 1 may also be integrated in a communication device.

On page 9, replace the paragraph beginning on line 1 with the following:

In accordance with FIG. 3, a transmitter *A* wants to communicate with a receiver *B*. For this purpose, the transmitter *A* sends the identification number of desired target device *B* (step *SA*1). The step of calling the receiver *B* automatically causes the channel hopping sequence of the receiver *B* stored in the device to be adjusted in the transmitter *A* (step

SA2).

On page 9, replace the paragraph beginning on line 5 with the following:

During this time, the receiver *B* is in the standby state, i.e., ready to receive. That is, the receiver cyclically runs through the unique channel hopping sequence specific to receiver *B* (step *SB*1). When the call from the transmitter *A* is received on the receiver *B* (step *SB2),* the receiver *B* sends a confirmation signal to the transmitter *A*.

On page 9, replace the paragraph starting on line 9 with the following:

The transmitter A waits for said confirmation from device *B* (waiting loop *SA3).* After receipt of confirmation the channel hopping sequence is halted on a predetermined channel. Then the synchronous clock is awaited in accordance with step *SA5*. The synchronous clock occurs in the transmitter *A* at the same time as in the receiver *B,* namely on the starting channel of the channel hopping sequence cycle.

On page 9, replace the paragraph starting on line 14 with the following:

In accordance with step *SA6* the channel hopping cycle is started after receipt of the synchronous clock signal. Both in the transmitter *A* and in the receiver *B* the same channel hopping sequence is now cyclically run through, in exact synchronism, so that data exchange between the two devices is possible (step *SA6* and step *SB3).*

On page 9, replace the paragraph starting on line 18 with the following:

In a slightly less favorable embodiment step *SA3* and also the confirmation in step *SB2* may be omitted.

On page 9, replace the paragraph starting on line 20 with the following:

FIG. 4 shows a functional block diagram of the channel selecting device 20 shown in FIG. 1. The program part 22 for the channel hopping sequence shown in FIG. 1 sends an item of data representative of the current channel hopping sequence, in the present example (see FIG. 2) the cyclical sequence 3, *5,* 2, 1, 3, *5,* ..., which is loaded into a register. The register cyclically feeds the individual positions to the channel switch 10. Synchronization between a transmitter and a receiver is effected here with the channel "3" at the highest position of the register. Clock 26 in FIG. 1 provides the clock signal (CLK) to the register so that the channels are hopped with the corresponding clock frequency.

On page 9, replace the paragraph starting at line 31 with the following:

FIG.5 shows a somewhat more detailed embodiment of the additional part 1 from FIG. 1. Over antenna 25 the public dial tone signal is received and fed to a minute and second evaluation means 40 which generates a minute signal and a second signal. The second signal and the minute signal are used for continuous synchronization of internal clock 42, on the one hand, and for synchronizing a transmitter with a receiver, on the other hand. Since the public time signal is received in synchronism simultaneously in each country, the present

invention utilizes this property of the time signal to synchronize transmitters and receivers at any distance from each other. The effort this requires is extremely low.

On page 10, replace the paragraph starting at line 8, with the following:

In FIG. 5, the clock 42 drives a program counter 45, a dwell counter 46 and a channel counter 48. The program counter 45 advances the channel counter 48. The dwell counter 46 temporarily halts the program counter 45 and the channel counter 48 so that data exchange in the course of connection setup is possible during this halting time period. After the dwell counter 46 has performed a number of counting steps corresponding to a certain time period it is reset to zero and the program counter 45 and channel counter 48 are simultaneously started.

On page 10, replace the paragraph starting on line 15 with the following:

Connected to the channel counter 48 is a drive interface 49 which connects to the channel switch 10 and has the function of galvanically decoupling the additional part 1 from the connected transceiver 2.

In the Abstract:

Amend the abstract as follows:

Transceivers which communicate with each other with a unique and synchronous channel hopping sequence are used to protect transmitted data signals. Each transceiver contains

along with the customary circuits for signal processing a program part for a channel hopping sequence a clock device which is synchronized by a public radio time signal, a channel selection circuit and a channel switch. The receiving and transmitting devices are both adjusted to a specific channel hopping sequence in accordance with the identification number of the receiving device so as to exclude the participation of further devices in communication. Channel hopping is effected at a relatively high frequency of approximately one megahertz so that there is no possibility of the connection being interrupted by a stronger transmitter, as is possible with conventional CB radio systems for example. Transmitter and receiver can be synchronized quickly and simply on the basis of the public time signal.

In the Claims:

Cancel claims 1-7 of the amended sheets of claims, without prejudice.

Please add new claims 8-15 as follows:

8. A system for transferring data signals over a communication link having a plurality of channels comprises a plurality of transceivers, wherein each of said plural transceivers comprises:

a transmitting section for conditioning input data for transmission of said input data over the communication link having the plurality of channels;

a receiving section for receiving signals from one of the plural channels of the communication link and processing the signals into output data;

a channel switching device connected to said transmitting section and said receiving section;

a channel hopping sequence program part including a plurality of channel hopping sequences programmed therein, said plural channel hopping sequences including a channel hopping sequence associated with said each of said plural transceivers;

a channel selecting device connected to said channel switching device and said channel hopping sequence program part for controlling said channel switching device in accordance with one of said plural channel hopping sequences; and

a clock device connected for operating said channel selecting device, said clock device being synchronized by a public time signal for synchronizing channel hopping between a transmitting one of said plural transceivers and a receiving one of said plural transceivers, wherein each of said plural transceivers comprises a unique identification number defining the channel hopping sequence associated with said each of said plural transceivers,

said unique identification number of the transmitting one of said plural transceivers being transmittable by said transmitting one of said plural transceivers and receivable by the receiving one of said plural transceivers for identification by the receiving one of said plural transceivers of the one of said plural channel hopping sequences associated with the transmitting one of said plural transceivers to used for a connection setup between said transmitting one and said receiving one of said plural transceivers.

9. The system of claim 8, wherein said clock device comprises a clock for generating an operating clock signal for the channel selecting device, said clock signal having a frequency within the range including 100 kHz to 10MHz.

10. The system of claim 8, wherein said frequency is approximately 1 MHz.

11. The system of claim 8, wherein said plural channel hopping sequences in said channel hopping sequence program part comprise all possible channel hopping sequences useable by said system.

12. The system of claim 11, wherein each of said plural channel hopping sequences are calculated from an algorithm base on said unique identification numbers of each of said plural transceivers.

13. An apparatus for processing transmit and receive signals, said apparatus being arrangable in a transceiver having a transmitting section and a receiving section and comprising:

a channel switching device connectable to the transmitting section and the receiving section of the transceiver;

a channel hopping sequence program part including a plurality of channel hopping sequences programmed therein, said plural channel hopping sequences including a channel hopping sequence associated with said each of a plurality of transceivers;

a channel selecting device connected to said channel switching device and said channel hopping sequence program part for controlling said channel switching device in accordance with one of said plural channel hopping sequences; and

a clock device connected for operating said channel selecting device, said clock device being synchronized by a public time signal for synchronizing channel hopping between a transmitting one of the plural transceivers and a receiving one of the plural transceivers.

14. A data transfer device for installation in a communication device arranged for at least one of transmitting and receiving data over one of a plurality of communications channels, said data transfer device comprising:

a channel switching device;

a channel hopping sequence program part including a plurality of channel hopping sequences programmed therein, said plural channel hopping sequences including a channel hopping sequence associated with said data transfer device;

a channel selecting device connected to said channel switching device and said channel hopping sequence program part for controlling said channel switching device in accordance with one of said plural channel hopping sequences; and

a clock device connected for operating said channel selecting device, said clock device being synchronized by a public time signal.

15. A method for synchronizing a data transfer operation between a transmitter and a receiver connected via a communication link having cyclically hopping channels, comprising the steps of:

(a) calling, by a transmitter, a desired receiver;

(b) adjusting a channel hopping sequence in both the transmitter and the desired receiver;

(c) receiving a public time signal at both the transmitter and the desired receiver; and

(d) synchronizing the transmitter and the receiver using a time signal including one of the public time signal and a signal derived from the public time signal by starting the channel hopping sequence of step (b) in synchronism with the time signal in both the transmitter and the desired receiver.

REMARKS

This preliminary amendment is presented to place the application in proper form for examination and to eliminate multiple dependency from the present claims. No new matter has been added. Early examination and favorable consideration of the above-identified application is earnestly solicited.

Any additional fees or charges required at this time in connection with the application may be charged to our Patent and Trademark Office Deposit Account No. 03-2412.

Respectfully submitted,
COHEN, PONTANI, LIEBERMAN & PAVANE

By: _____

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16 April 2001

VERSION WITH MARKINGS TO SHOW CHANGES

In the Specification:

On Page 1, after line 2, insert the following heading:

--BACKGROUND OF THE INVENTION

1. Field of the Invention--

On page 1, after line 4, insert the following heading:

--2. Description of the Prior Art--

On page 2, after line 26, insert the following:

--3. Summary of the Invention--

On page 2, replace the paragraphs starting on lines 27 and 31 with the following:

[The invention is based on the problem of providing] An object of the present invention is to provide an apparatus which permits safe data transfer with simple means along with fast and simple synchronization of transmitter and receiver. [Furthermore,] A further object is to provide a simple and reliable synchronization method [is to be stated].

[The problem is solved according to] The object of the invention [in] is met by a transceiver for data signals that has the following features:

a transmitting section which conditions input data for transmission over a communication link containing a plurality of channels,

a receiving station which receives signals from one of the channels and processes them into output data,

a channel switching device connected to the transmitting section and the receiving section,

a channel hopping program part in which a plurality of predetermined channel hopping sequences are programmed, a predetermined channel hopping sequence being associated with the transceiver as an address,

a channel selecting device which controls the channel switching device in accordance with a predetermined channel hopping sequence, and

a clock device for operating the channel selecting device, the clock device being synchronized by a public time signal (radio clock) to synchronize channel hopping between a transmitting and a receiving transceiver with the aid of the public time signal.

On page 4, replace the paragraph on line 8 with the following:

The receiver called by a transmitting device confirms [dialing] the calling and the transmitting device synchronizes itself with the receiver. Since only said two devices work in synchronism in the channel hopping sequence specific to this connection and stay only in the particular channel for only a relatively short time, one obtains protection for the transferred data

signals, on the one hand, and prevents a stronger signal from being able to terminate the connection, on the other hand.

On page 5, replace the paragraph beginning on line 22 with the following:

The invention furthermore provides a method for synchronizing transceiving operation between a transmitter and a receiver which are connected over a communication link with cyclically hopping channels, comprising the following steps:

the transmitter *(A)* [dials] calls a desired receiver *(B)*,

the same channel hopping sequence is adjusted in the transmitter *(A)* and the receiver *(B)*,

transmitter *(A)* and receiver *(B)* both receive a public time signal,

transmitter and receiver are synchronized by the time signal or a signal derived therefrom by the channel hopping cycle being started on a previously defined channel in synchronism with the time signal both in the transmitter and the receiver.

On page 6, before the first line insert the following heading:

--BRIEF DESCRIPTION OF THE DRAWINGS--;

On page 6, replace the paragraph beginning on line 1 with the following:

[In the following an example of the invention will be explained more closely on the basis of the drawing.] In the drawings, wherein like reference characters denote similar elements throughout the several views:

FIG. 1 [shows] is a block diagram of a transceiver with a device executed as an additional device for automatic and continuous hopping of transmission channels[.],

[FIG. 2 shows schematically] FIGS. 2a and 2b are timing diagrams showing the setup of a connection between two transceivers[.];

[FIG. 3 shows] FIGS. 3a and 3b are flow charts showing the operation of a transmitter and receiver in accordance with the invention [in comparison in the form of a flowchart.] ;

FIG. 4 is a functional block diagram of a channel selecting device[.] ; and

FIG. 5 is a block diagram of an embodiment of an additional part of a transceiver shown in FIG. 1 at the bottom right.

On page 6, after line 10 insert the following heading:

--**DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS**--

On page 6, replace the paragraph beginning on line 11 as follows:

As indicated [by the figure] in FIG. 1, the transceiver contains a radio data transmission device 2 known in the art which is equipped with an inventive additional part 1 for protecting the transfer of the data signals. [Additional] The additional part 1 forms a data transfer device suitable for installation in any devices used for data transfer.

On page 6, replace the paragraph starting on line 19 as follows:

Departing from the representation in [the figure] FIG. 1, additional part 1 may also be integrated in transceiver 2.

On page 6, replace the paragraph beginning on line 21 with the following:

[Data] A data signal source 4, for example an [LF section] audio frequency part connected to a microphone, provides data signals to a signal conditioning circuit 6 via a channel switch 10. Signal conditioning circuit 6 modulates the data signals to condition them for radiation through an antenna 8. In customary transceivers, the channel switch 10 is formed as a manual selector switch for selecting one of the available channels. Reception of data is effected similarly to transmission of data. The receive signals coming through the antenna 8 are demodulated, amplified, etc., in a signal conditioning circuit 12 and then fed via the channel switch 10 to a data signal sink 14, shown in general form here, having loudspeaker 16 connected thereto for example. The details of the device generally described here are known from the prior art and shall not be explained more closely.

On page 6, replace the paragraphs beginning on line 31 with the following:

Additional part 1 shown on the bottom right in [the figure] Fig. 1 is used for fast and continuous change-over of the particular "active" channel in channel switch 10. For this purpose, the channel switch 10 has connected thereto a channel selecting device 20 which is in

turn driven by a channel hopping sequence program part 22[. Program part 22] which contains a processor and a memory.

On page 7, replace the paragraph starting on line 4 as follows:

Time synchronization of a transmitting and a receiving device is effected with the aid of a clock device containing a time signal generator 24 and a clock 26. For this purpose, the time signal generator 24 receives [the] a public time signal (the signal DCF 77 in Germany) though an antenna 25 and forms therefrom a second clock signal *s* and a minute clock signal *m*. [Second] The second clock signal *s* is fed to the clock 26 which generates in synchronism with the second clock signal *s* a fast pulse train, in the present case a pulse train with a frequency of one megahertz.

On page 7, replace the paragraph starting on line 11 as follows:

In the program part 22 for the channel hopping sequence a plurality of channel hopping sequences are stored.

On page 7, replace the paragraph starting on line 15 as follows:

When one user of the CB radio system wants to speak to another user with a transceiver of the kind shown in [the figure] FIG. 1, he enters the receiver's identification number via a keyboard not shown. A corresponding code goes via the signal source 4 and the channel switch 10 into the signal conditioning circuit 6. The receiver called, which has the

same [device as] components as the radio data transmission device 2 shown in [the figure] FIG. 1, is in the standby state, thus receiving through its own antenna 8 the calling signal which is processed via the signal conditioning circuit 12 and channel switch 10 so that the call is then recognized.

On page 7, replace the paragraph starting on line 22 as follows:

The [dialing] calling operation causes the channel hopping sequence belonging to the selected identification number to be adjusted in the transmitting device. In order to be able to communicate with the [dialed device] called receiver the transmitter must synchronize itself with the receiver. This is done with the aid of the time signal generator 24 which provides synchronous minute and second signals in all devices. For example, a certain data word is fed to the channel selection circuit 20 in the transmitting device by the program part 22, [said] the data word being a channel hopping sequence specific to the identification number. Furthermore, the channel where synchronization is to begin is fixed in advance. At the following minute clock signal the channel where synchronization is to begin is held for a short time period by corresponding circuit-technology measures in the devices. After [expiry of] this time period has expired, the transmitter and the receiver work with a synchronous, identical channel hopping sequence. [Clock] The clock 26 can feed a high-frequency signal (one megahertz) to the channel selection circuit 20 which then feeds a corresponding control signal to the channel switch 10. The data are then changed over between the different channels in identical fashion both in the [transmitting] transmitter and in the [received] receiver [device].

Since only [said two devices] the transmitter and receiver work in synchronism with this specific channel hopping sequence, all other devices are excluded from communication.

On page 8, replace the paragraph starting on line 7 as follows:

[Channel] The channel selection circuit 20 may be for example a register in which a certain pattern identifying the selected channel is stored at each clock. The content of the shift register may be deposited in a memory (EPROM). However, it is also possible to determine the channel hopping sequence on the basis of an algorithm, said algorithm processing the identification number into the channel hopping sequence.

On page 8, replace the paragraph starting on line 12 as follows:

[FIG. 2] FIGS. 2a and 2b shows the simplified case of a system with five channels 1, 2 ... 5 and a clock cycle comprising four clocks. FIG. 2a shows cyclical hopping of channels 1, 3, 5, 2, 1, 3, 5 ... of device 1 called by device 2, i.e., device 1 is the receiver and device 2 is the transmitter. The call by [transmitting device] the transmitter 2 causes the channel sequence of [device] the transmitter 2 to be replaced at that moment by that of [device] the receiver 1 and a "start signal" for synchronization to be adjusted, channel "3" here. When these adjustments are finished, [device] the transmitter 2 waits for the next agreed time clock, e.g. the second clock of the public time signal. When said second clock, t2, comes, the channel hopping sequence begins in [device] the transmitter 2.

On page 8, replace the paragraph starting on line 20 as follows:

The [two devices] transmitter 2 and receiver 1 are now working fully identically, in terms of channel selection. Accordingly, the two devices can also open a "window" for other data devices. For this purpose a defined channel is e.g. held for several seconds, e.g. in synchronism with the minute clock. In this time other users can dial in. At the end of the "window" all user devices begin to work with identical synchronous channel hopping sequences. Opening the "window", i.e. holding a certain channel in a time interval lasting e.g. a few seconds, can be effected with a special button.

On page 8, replace the paragraph starting on line 27 as follows:

All circuit parts described above and shown in the drawing can be produced with commercial components in the way known to [the expert] one skilled in the art of data transmission in communication devices. [Additional] The additional part 1 in FIG. 1 [can] may also be integrated in a communication device.

On page 9, replace the paragraph beginning on line 1 with the following:

In accordance with FIG. 3, a transmitter *A* wants to communicate with a receiver *B*. For this purpose, the transmitter *A* sends the identification number of desired target device *B* (step *SA*). [Dialing device] The step of calling the receiver *B* automatically causes the channel hopping sequence of [device] the receiver *B* stored in the device to be adjusted in the transmitter *A* (step *SA2)*.

On page 9, replace the paragraph beginning on line 5 with the following:

During this time, the receiver *B* is in the standby state, i.e., ready to receive. That is, [(ready-to-receive) it] the receiver cyclically runs through the unique channel hopping sequence specific to [device] receiver *B* (step *SB* 1). When the call from [device] the transmitter *A* is received on [device] the receiver *B* (step *SB2),* [device] the receiver *B* sends a confirmation signal to [device] the transmitter *A*.

On page 9, replace the paragraph starting on line 9 with the following:

[Device] The transmitter awaits for said confirmation from device *B* (waiting loop *SA3).* After receipt of confirmation the channel hopping sequence is halted on a predetermined channel. Then the synchronous clock is awaited in accordance with step *SA5.* The synchronous clock occurs in the transmitter *A* at the same time as in [device] the receiver *B,* namely on the starting channel of the channel hopping sequence cycle.

On page 9, replace the paragraph starting on line 14 with the following:

In accordance with step *SA6* the channel hopping cycle is started after receipt of the synchronous clock signal. Both in the transmitter *A* and in the receiver *B* the same channel hopping sequence is now cyclically run through, in exact synchronism, so that data exchange between the two devices is possible (step *SA6* and step *SB3).*

On page 9, replace the paragraph starting on line 18 with the following:

In a slightly less favorable embodiment [one can omit] step *SA3* and also the confirmation in step *SB2* may be omitted.

On page 9, replace the paragraph starting on line 20 with the following:

FIG. 4 shows a functional block diagram of the channel selecting device 20 shown in FIG. 1. [From the] The program part 22 for the channel hopping sequence shown in FIG. 1 sends an item of data representative of the current channel hopping sequence, in the present example (see FIG. 2) the cyclical sequence 3, 5, 2, 1, 3, 5, ..., which is loaded into a register. The register cyclically feeds the individual positions to the channel switch 10. Synchronization between a transmitter and a receiver is effected here with the channel "3" at the highest position of the register. Clock 26 in FIG. 1 provides the clock signal (CLK) to the register so that the channels are hopped with the corresponding clock frequency.

On page 9, replace the paragraph starting at line 31 with the following:

FIG.5 shows a somewhat more detailed embodiment of the additional part 1 from FIG. 1. Over antenna 25 the public dial tone signal is received and fed to a minute and second evaluation means 40[. Circuit 40] which generates a minute signal and a second signal. [Said] The second signal and the minute signal[s] are used for continuous synchronization of internal clock 42, on the one hand, and for synchronizing a transmitter with a receiver, on the other hand. Since the public time signal is received in synchronism simultaneously in each

country, the present invention utilizes this property of the time signal to synchronize transmitters and receivers at any distance from each other. The effort this requires is extremely low.

On page 10, replace the paragraph starting at line 8, with the following:

In FIG. 5, the clock 42 drives a program counter 45, a dwell counter 46 and a channel counter 48. [Program] The program counter 45 [serves to advance] advances the channel counter 48. [Dwell] The dwell counter 46 temporarily halts the program counter 45 and the channel counter 48 so that data exchange in the course of connection setup is possible during this halting time period. After the dwell counter 46 has performed a number of counting steps corresponding to a certain time period it is reset to zero and the program counter 45 and channel counter 48 [being] are simultaneously started.

On page 10, replace the paragraph starting on line 15 with the following:

Connected to the channel counter 48 is a drive interface 49 [having the function of] which connects to the channel switch 10 and has the function of galvanically decoupling [device] the additional part 1 from the connected transceiver 2.

In the Abstract:

Amend the abstract as follows:

[For protecting transmitted data signals one uses transceivers] Transceivers which communicate with each other with a unique and synchronous channel hopping sequence are used to protect transmitted data signals. [For this purpose each] Each transceiver contains along with the customary circuits for signal processing a program part [(22)] for a channel hopping sequence [and] a clock device [(24,26)] which is synchronized by a public radio time signal, [as well as] a channel selection circuit [(20)] and a channel switch [(10)]. [In case of a call the] The receiving and transmitting devices are both adjusted to a [certain] specific channel hopping sequence in accordance with the identification number of the receiving device so as to exclude the participation of further devices in communication. Channel hopping is effected at a relatively high frequency of approximately one megahertz so that there is no possibility of the connection being interrupted by a stronger transmitter, as is possible with conventional CB radio systems for example. Transmitter and receiver can be synchronized quickly and simply on the basis of the public time signal.

[FIG. 1]

Transceiver for data signals, system for transferring data signals, apparatus for installation in a transceiver, and synchronization method

This invention relates to a transceiver for data signals, in particular radio data signals.

The term "data signals" includes any kind of signal containing data (messages), for example audio, video or computer data, but also control data and the like.

The term "transceiver" refers to a device suitable for both transmitting and receiving data signals. An example of a transceiver is a CB radio set. However, the invention is fundamentally applicable to all devices suitable for receiving and transmitting data. The advantages of the invention are particularly clear in radio data transfer, but the invention is also suitable for transfer over wire-bound channels.

The term "communication link" thus involves for example a group of radio channels/frequencies, but also a group of channels in a network-bound communication system. The term "channel" in intended here to refer specifically to a certain frequency band from a plurality of frequency bands. However, it is also fundamentally possible within the scope of the invention to realize individual channels of a communication link by corresponding time windows in a predetermined time slot.

The invention is executed in particular as a discrete apparatus which can be installed in existing conventional transceivers to process transmit signals and/or receive signals. The invention thus provides a data transfer device with which one can equip devices used for data transfer e.g. to protect transfer from "eavesdropping".

The invention can be explained here specifically by the example of CB radio. A disadvantage in current radio transmissions is the ready possibility of eavesdropping and logging data, for which purpose one need simply connect a transceiver into the channel over which two transceivers are communicating with each other.

Encryption of transmitted data by cryptographic measures is relatively elaborate, the data can be logged, i.e. recorded and decrypted later.

A further disadvantage in radio transmissions is the possibility of a stronger transmitter interrupting a connection between two users by the stronger signal simply displacing the weaker signal.

The change of available channels of a communication link during a communication process is known in a special embodiment as frequency hopping. For example, DE 27 47 454 C1 shows a communication system with frequency hopping. The message (data) to be transmitted are modulated in sections upon different carrier frequencies, the cyclically changing sequence of the carrier frequencies being programmed according to a given protocol. Frequency hopping offers the advantage, among other things, of obtaining relatively high safety from eavesdropping. So that the receiver can completely receive the message sent by the transmitter, the receiver must retrace the frequency hops in synchronism with the transmitting operation.

Synchronizing transmitter and receiver requires considerable effort. One possibility is the so-called hand-shake method by which transmitter and receiver first exchange synchronization signals as preparation for transmitting a message and then start actual message transmission when synchronization has been effected. Both the initiation of message transmission and the message transmission itself follow a strictly prescribed protocol. It is known to reserve a separate channel for purposes of synchronization (US-A-5 502 722).

It is furthermore known in transmission of short messages by frequency hopping to transmit the message several times asynchronously to the receiver which is synchronized with the transmitter until a message has been completely received once (DE-A-43 37 212). Because of the special synchronization between transmitter and receiver it is virtually impossible in the prior art for a third user to cut into an ongoing call. Such cutting in or operator override by one or more further users may be advantageous specifically in speech transmission systems (for example CB radio) when it is expressly desired by the two original callers. Operator override would require considerable synchronization effort in the prior art, comparable with the effort required for setting up a connection between a transmitter and a receiver.

The invention is based on the problem of providing an apparatus which permits safe data transfer with simple means along with fast and simple synchronization of transmitter and receiver. Furthermore, a simple and reliable synchronization method is to be stated.

This problem is solved according to the invention in a transceiver for data signals that has the following features:

a transmitting section which conditions input data for transmission over a communication link containing a plurality of channels,

a receiving section which receives signals from one of the channels and processes them into output data,

a channel switching device connected to the transmitting section and receiving section,

a channel hopping program part in which a plurality of predetermined channel hopping sequences are programmed, a predetermined channel hopping sequence being associated with the transceiver as an address,

a channel selecting device which controls the channel switching device in accordance with a predetermined channel hopping sequence, and

a clock device for operating the channel selecting device, the clock device being synchronized by a public time signal (radio clock) to synchronize channel hopping between a transmitting and a receiving transceiver with the aid of the public time signal.

The transmitting section conditions the data, for example audio data, from a data signal source for radiation through an antenna. The thus conditioned data signals have a certain transmitter frequency, and thus accordingly a certain channel.

The same applies to the receiving section. The channel switching device provides a constantly changing selection of one channel from the amount of available channels. The clock device provides the clock whose frequency determines how fast hopping between the different channels takes place. The special channel hopping sequence is unique and identical for each connection between two or more users. Furthermore, the clock device provides the sync signals derived from the public time signal.

In a communication system each transceiver is equipped for example with a special identification number, said identification number being uniquely linked with a special channel hopping sequence, i.e. in particular frequency hopping sequence.

Each transceiver, i.e. in particular the inventive data transfer device installed in the transceiver, contains the information on this link for all transceivers, e.g. stored in an EPROM. A device in the standby state cyclically performs its particular channel hopping sequence.

When the transmitting device calls a desired user by entry of the receiver's identification number, the channel hopping sequence belonging to the selected identification number is adjusted in the transmitting device. The clock device synchronizes the channel hopping sequence in the transmitting device. Change-over is typically effected in the order of magnitude of one megahertz, corresponding to a dwell time of approximately one microsecond within a channel. Synchronization is effected with the aid of the public time signal, thus being obtained quickly and easily.

The receiver called by a transmitting device confirms dialing, and the transmitting device synchronizes itself with the receiver. Since only said two devices work in synchronism in the channel hopping sequence specific to this connection and stay only in the particular channel for only a relatively short time, one obtains protection for the transferred data signals, on the one hand, and prevents a stronger signal from being able to terminate the connection, on the other hand.

Utilization of the public time signal (DCF 77 in Germany; MFS in the United Kingdom; WWVB in the USA) permits the two communicating devices to be perfectly synchronized, for which one can use the basic minute and second clock signals of the public time signal which is identical and synchronous world-wide. Any desired sync signals can be derived from said time signal.

The inventive system for transferring data signals contains a number of transceivers each formed according to the invention and having a unique identification number. Said identification number determines the channel hopping sequence with which this device communicates with another device, namely as a receiving device, that is, a device dialed by another device. For connection setup the identification number sent by a transmitting device also determines the predetermined channel hopping sequence in the transmitting device itself. This excludes other users from taking part in data transmission. Another user's attempt to cut into the ongoing call is excluded with very high probability since the two users' time synchronization is unknown to outsiders.

Excluding further users from data transmission is an advantage of the present invention, but the invention also offers the converse possibility of two users involved in data transmission expressly permitting one or more further users to take part. For this

purpose the synchronization of ongoing data transmission is halted temporarily and started again after a pause so that a further user can take part after the start.

The special kind of in particular cyclical channel hopping sequence may be stored in the program part. However, one may also determine the channel hopping sequence from the identification number by calculation with the aid of an algorithm.

The invention furthermore provides an apparatus suitable for retrofitting which, to adapt to the particular transfer device, ensures a certain continuous channel hopping during a data transfer, synchronized with one or more receivers. In particular, the invention provides a data transfer device for installation in a communication device which sends data to another device and/or receives data from the other device over one of a given number of channels, in particular frequency channels, comprising the following features:

a channel switching device,

a channel hopping sequence program part in which a plurality of predetermined channel hopping sequences are programmed, a predetermined channel hopping sequence being associated with the data transfer device,

a channel selecting device which controls the channel switching device in accordance with one of the predetermined channel hopping sequences, and

a clock device with a synchronizing device for operating the channel selecting device,

the clock device being synchronized by a public time signal (radio clock).

The invention furthermore provides a method for synchronizing transceiving operation between a transmitter and a receiver which are connected over a communication link with cyclically hopping channels, comprising the following steps:

the transmitter (*A*) dials a desired receiver (*B*),

the same channel hopping sequence is adjusted in the transmitter (*A*) and the receiver (*B*),

transmitter (*A*) and receiver (*B*) both receive a public time signal,

transmitter and receiver are synchronized by the time signal or a signal derived therefrom by the channel hopping cycle being started on a previously defined channel in synchronism with the time signal both in the transmitter and the receiver.

In the following an example of the invention will be explained more closely on the basis of the drawing.

FIG. 1 shows a block diagram of a transceiver with a device executed as an additional device for automatic and continuous hopping of transmission channels.

FIG. 2 shows schematically the setup of a connection between two transceivers.

FIG. 3 shows the operation of a transmitter and receiver in accordance with the invention in comparison in the form of a flowchart.

FIG. 4 is a functional block diagram of a channel selecting device.

FIG. 5 is a block diagram of an embodiment of an additional part for a transceiver shown in FIG. 1 at the bottom right.

As indicated by the figure, the transceiver contains radio data transmission device 2 known in the art which is equipped with inventive additional part 1 for protecting transfer of the data signals. Additional part 1 forms a data transfer device suitable for installation in any devices used for data transfer.

As mentioned above, radio data transmission is selected only as an example here for explaining the invention. The invention can fundamentally be used in all devices able to transmit and receive data, transfer being effected over one of a plurality of possible channels.

Departing from the representation in the figure, additional part 1 may also be integrated in transceiver 2.

Data signal source 4, for example an LF section connected to a microphone, provides data signals to signal conditioning circuit 6 via channel switch 10. Signal conditioning circuit 6 modulates the data signals to condition them for radiation through antenna 8. In customary transceivers, channel switch 10 is formed as a manual selector switch for selecting one of the available channels. Reception of data is effected similarly to transmission of data. The receive signals coming through antenna 8 are demodulated, amplified, etc., in signal conditioning circuit 12 and then fed via the channel switch to data signal sink 14, shown in general form here, having loudspeaker 16 connected thereto for example. The details of the device generally described here are known from the prior art and shall not be explained more closely.

Additional part 1 shown on the bottom right in the figure is used for fast and continuous change-over of the particular "active" channel in channel switch 10. For this

purpose channel switch 10 has connected thereto channel selecting device 20 which is in turn driven by channel hopping sequence program part 22. Program part 22 contains a processor and a memory.

Time synchronization of a transmitting and a receiving device is effected with the aid of a clock device containing time signal generator 24 and clock 26. For this purpose, time signal generator 24 receives the public time signal (the signal DCF 77 in Germany) through antenna 25 and forms therefrom second clock signal *s* and minute clock signal *m*. Second clock signal *s* is fed to clock 26 which generates in synchronism with second clock signal *s* a fast pulse train, in the present case a pulse train with a frequency of one megahertz.

In program part 22 for the channel hopping sequence a plurality of channel hopping sequences are stored.

In the following, the operation of the device with protection of communication by fast channel hopping will be explained.

When one user of the CB radio system wants to speak to another user with a transceiver of the kind shown in the figure, he enters the receiver's identification number via a keyboard not shown. A corresponding code goes via signal source 4 and the channel switch into the signal conditioning circuit. The receiver called, which has the same device as shown in the figure, is in the standby state, thus receiving through antenna 8 the calling signal which is processed via signal conditioning circuit 12 and channel switch 10 so that the call is then recognized.

The dialing operation causes the channel hopping sequence belonging to the selected identification number to be adjusted in the transmitting device. In order to be able to communicate with the dialed device the transmitter must synchronize itself with the receiver. This is done with the aid of time signal generator 24 which provides synchronous minute and second signals in all devices. For example, a certain data word is fed to channel selection circuit 20 in the transmitting device by program part 22, said data word being a channel hopping sequence specific to the identification number. Furthermore, the channel where synchronization is to begin is fixed in advance. At the following minute clock signal the channel where synchronization is to begin is held for a short time period by corresponding circuit-technology measures in the devices. After expiry of this time period, transmitter and receiver work with a syn-

chronous, identical channel hopping sequence. Clock 26 can feed a high-frequency signal (one megahertz) to channel selection circuit 20 which then feeds a corresponding control signal to channel switch 10. The data are then changed over between the different channels in identical fashion both in the transmitting and in the received device. Since only said two devices work in synchronism with this specific channel hopping sequence, all other devices are excluded from communication.

Channel selection circuit 20 may be for example a register in which a certain pattern identifying the selected channel is stored at each clock. The content of the shift register may be deposited in a memory (EPROM). However, it is also possible to determine the channel hopping sequence on the basis of an algorithm, said algorithm processing the identification number into the channel hopping sequence.

FIG. 2 shows the simplified case of a system with five channels 1, 2 ... 5 and a clock cycle comprising four clocks. FIG. 2a shows cyclical hopping of channels 1, 3, 5, 2, 1, 3, 5 ... of device 1 called by device 2. The call by transmitting device 2 causes the channel sequence of device 2 to be replaced at that moment by that of device 1 and a "start signal" for synchronization to be adjusted, channel "3" here. When these adjustments are finished, device 2 waits for the next agreed time clock, e.g. the second clock of the public time signal. When said second clock, *t*2, comes, the channel hopping sequence begins in device 2.

The two devices are now working fully identically, in terms of channel selection. Accordingly, the two devices can also open a "window" for other data devices. For this purpose a defined channel is e.g. held for several seconds, e.g. in synchronism with the minute clock. In this time other users can dial in. At the end of the "window" all user devices begin to work with identical synchronous channel hopping sequences. Opening the "window", i.e. holding a certain channel in a time interval lasting e.g. a few seconds, can be effected with a special button.

All circuit parts described above and shown in the drawing can be produced with commercial components in the way known to the expert. Additional part 1 in FIG. 1 can also be integrated in a communication device.

The procedure shown above for setting up a connection between a transmitter and a receiver is schematically shown in FIG. 3 with the aid of a flowchart.

In accordance with FIG. 3, transmitter *A* wants to communicate with receiver *B*. For this purpose, transmitter *A* sends the identification number of desired target device *B* (step *SA*1). Dialing device *B* automatically causes the channel hopping sequence of device *B* stored in the device to be adjusted in transmitter *A* (step *SA*2).

During this time, receiver *B* is in the standby state. That is, (ready-to-receive) it cyclically runs through the unique channel hopping sequence specific to device *B* (step *SB*1). When the call from device *A* is received on device *B* (step *SB*2), device *B* sends a confirmation signal to device *A*.

Device A waits for said confirmation from device *B* (waiting loop *SA*3). After receipt of confirmation the channel hopping sequence is halted on a predetermined channel. Then the synchronous clock is awaited in accordance with step *SA*5. The synchronous clock occurs in transmitter *A* at the same time as in device *B*, namely on the starting channel of the channel hopping sequence cycle.

In accordance with step *SA*6 the channel hopping cycle is started after receipt of the synchronous clock signal. Both in transmitter *A* and in receiver *B* the same channel hopping sequence is now cyclically run through, in exact synchronism, so that data exchange between the two devices is possible (step *SA*6 and step *SB*3).

In a slightly less favorable embodiment one can omit step *SA*3 and also the confirmation in step *SB*2.

FIG. 4 shows a functional block diagram of channel selecting device 20 shown in FIG. 1. From the program part for the channel hopping sequence shown in FIG. 1 an item of data representative of the current channel hopping sequence, in the present example (see FIG. 2) the cyclical sequence 3, 5, 2, 1, 3, 5, ..., is loaded into a register. The register cyclically feeds the individual positions to channel switch 10. Synchronization between a transmitter and a receiver is effected here with the channel "3" at the highest position of the register. Clock 26 in FIG. 1 provides the clock signal (*CLK*) to the register so that the channels are hopped with the corresponding clock frequency.

As mentioned above, the channel selecting device can also work in such a way that an item corresponding to the current channel is loaded into a register at each channel hop.

FIG. 5 shows a somewhat more detailed embodiment of additional part 1 from FIG. 1. Over antenna 25 the public dial tone signal is received and fed to minute *and*

second evaluation means 40. Circuit 40 generates a minute signal and a second signal. Said second and minute signals are used for continuous synchronization of internal clock 42, on the one hand, and for synchronizing a transmitter with a receiver, on the other hand. Since the public time signal is received in synchronism simultaneously in each country, the present invention utilizes this property of the time signal to synchronize transmitters and receivers at any distance from each other. The effort this requires is extremely low.

In FIG. 5, clock 42 drives program counter 45, dwell counter 46 and channel counter 48. Program counter 45 serves to advance channel counter 48. Dwell counter 46 temporarily halts program counter 45 and channel counter 48 so that data exchange in the course of connection setup is possible during this halting time period. After dwell counter 46 has performed a number of counting steps corresponding to a certain time period it is reset to zero, program counter 45 and channel counter 48 being simultaneously started.

Connected to channel counter 48 is drive interface 49 having the function of galvanically decoupling device 1 from the connected transceiver.

Patent claims

1. A system for transferring data signals, in particular radio data signals, having transceivers each comprising:
a transmitting section (6) which conditions input data for transmission over a communication link containing a plurality of channels,
a receiving section (12) which receives signals from one of the channels and processes them into output data,
a channel switching device (10) connected to the transmitting section and receiving section,
a channel hopping sequence program part (22) in which a plurality of predetermined channel hopping sequences are programmed, a predetermined channel hopping sequence being associated with the transceiver as an address,
a channel selecting device (20) which controls the channel switching device (10) in accordance with one of the predetermined channel hopping sequences, and
a clock device (24, 26) for operating the channel selecting device (20), the clock device being synchronized by a public time signal (radio clock) to synchronize channel hopping between a transmitting and a receiving transceiver with the aid of the public time signal,
a unique identification number being associated with each transceiver to define a certain channel hopping sequence for the transceiver, and the identification number inputted by a transmitting device also determining the predetermined channel hopping sequence of the receiving device in the transmitting device itself for connection setup.

2. A system according to claim 1, characterized in that the clock device (24, 26) has a clock (26) for generating an operating clock signal for the channel selecting device, the frequency of the clock signal outputted by the clock being 100 kilohertz ... 10 megahertz, preferably approximately one megahertz.

3. A system according to claim 1, characterized in that all possible channel hopping sequences are stored in the program part.

4. A system according to claim 3, characterized in that the channel hopping sequences are calculated from the selected identification number on the basis of an algorithm.

5. An apparatus for processing transmit and receive signals for installation in a transceiver of the system according to any of claims 1 to 4, having the channel switching device, the channel hopping sequence program part, the channel selecting device and the clock device.

6. A data transfer device for installation in a communication device which sends data to another device and/or receives data from the other device over one of a given number of channels, in particular frequency channels,
comprising the following features:
a channel switching device (10),
a channel hopping sequence program part (22) in which a plurality of predetermined channel hopping sequences are programmed, a predetermined channel hopping sequence being associated with the data transfer device,
a channel selecting device (20) which controls the channel switching device (10) in accordance with one of the predetermined channel hopping sequences, and
a clock device (24, 26) with a synchronizing device for operating the channel selecting device (20),
the clock device (24, 26) being synchronized by a public time signal (radio clock).

7. A method for synchronizing transceiving operation between a transmitter and a receiver which are connected over a communication link with cyclically hopping channels, comprising the following steps:
the transmitter (*A*) dials a desired receiver (*B*),
the same channel hopping sequence is adjusted in the transmitter (*A*) and the receiver (*B*),
transmitter (*A*) and receiver (*B*) both receive a public time signal.
transmitter and receiver are synchronized by the time signal or a signal derived therefrom by the channel hopping cycle being started on a previously defined channel in synchronism with the time signal both in the transmitter and the receiver.

FIG.1

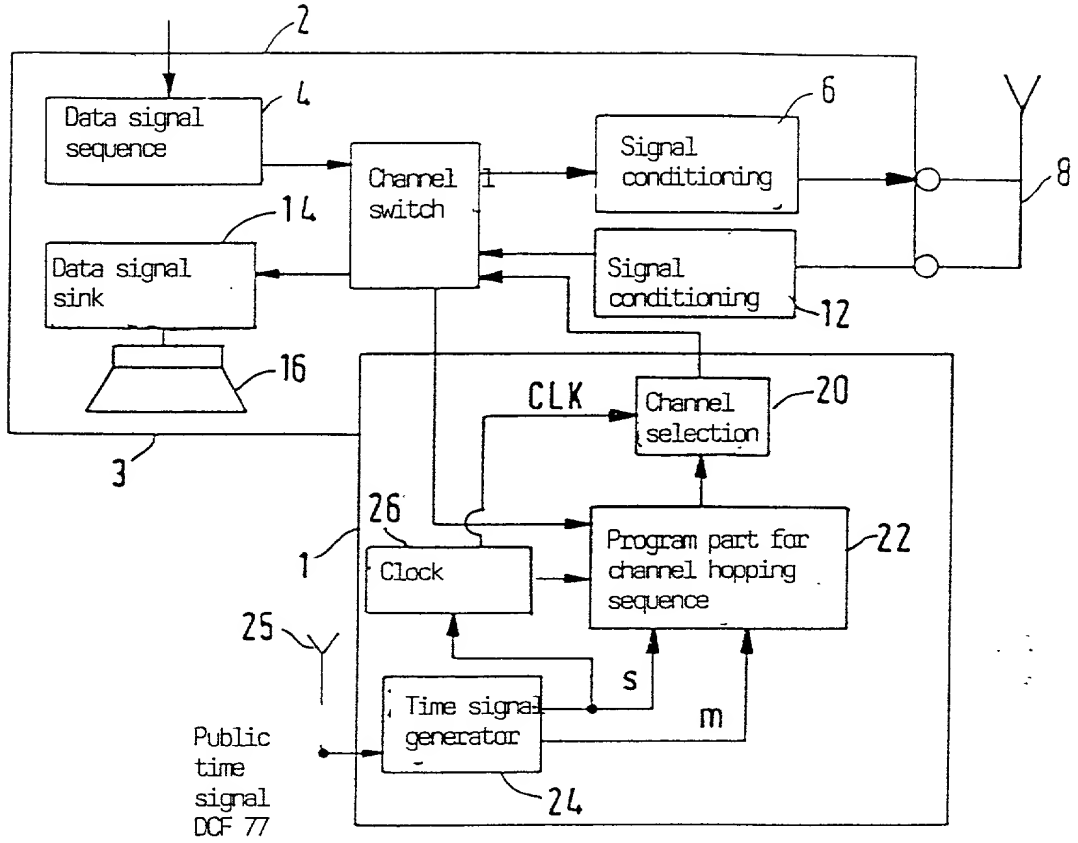


FIG. 2A

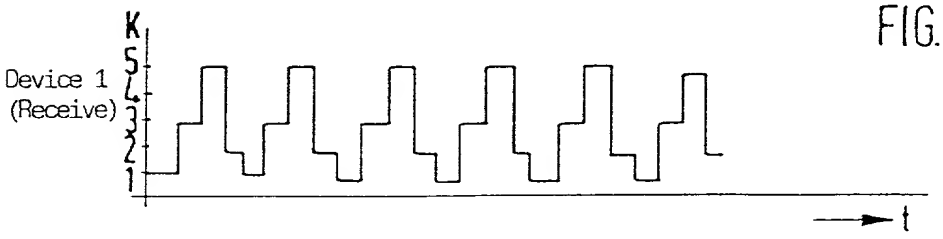
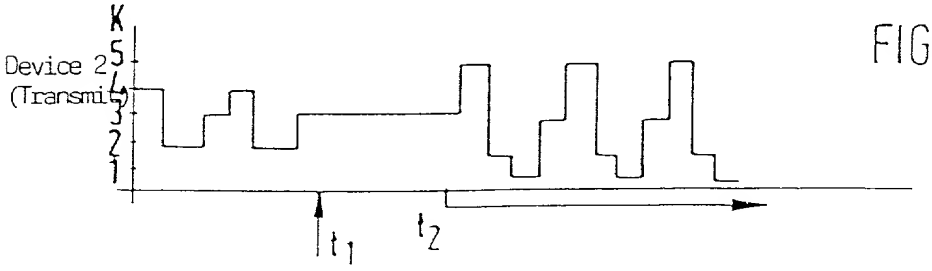


FIG 2B



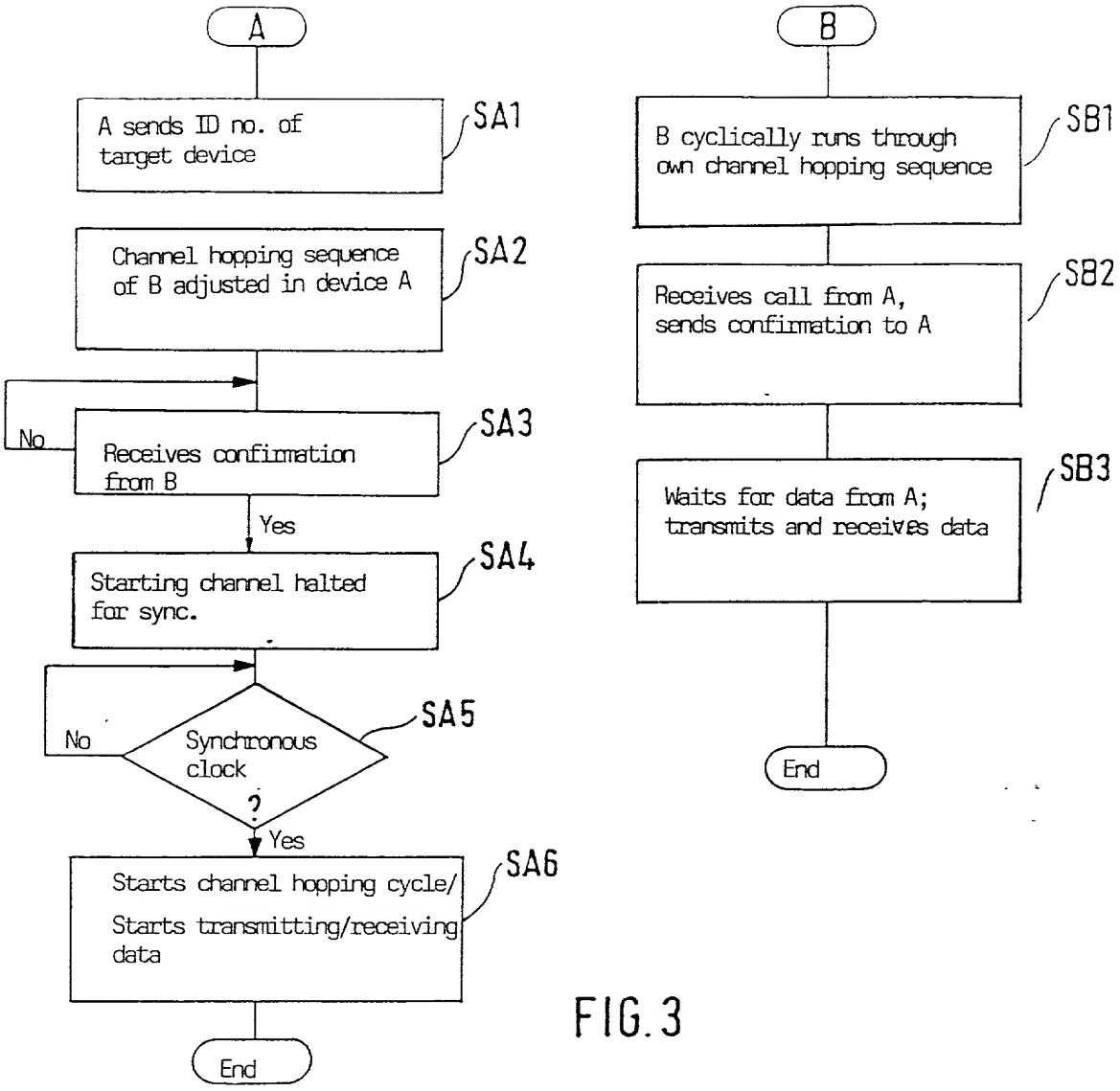

A
A sends ID no. of target device
SA1
Channel hopping sequence of B adjusted in device A
SA2
No
Receives confirmation from B
SA3
Yes
Starting channel halted for sync.
SA4
No
Synchronous clock
?
SA5
Yes
Starts channel hopping cycle/
Starts transmitting/receiving data
SA6
End
B
B cyclically runs through own channel hopping sequence
SB1
Receives call from A, sends confirmation to A
SB2
Waits for data from A; transmits and receives data
SB3
End

FIG.3

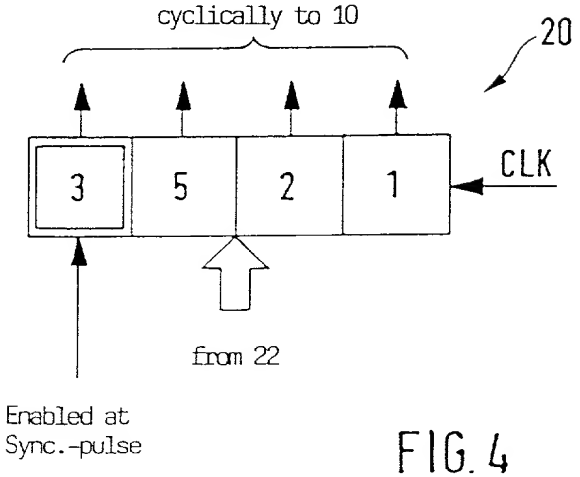
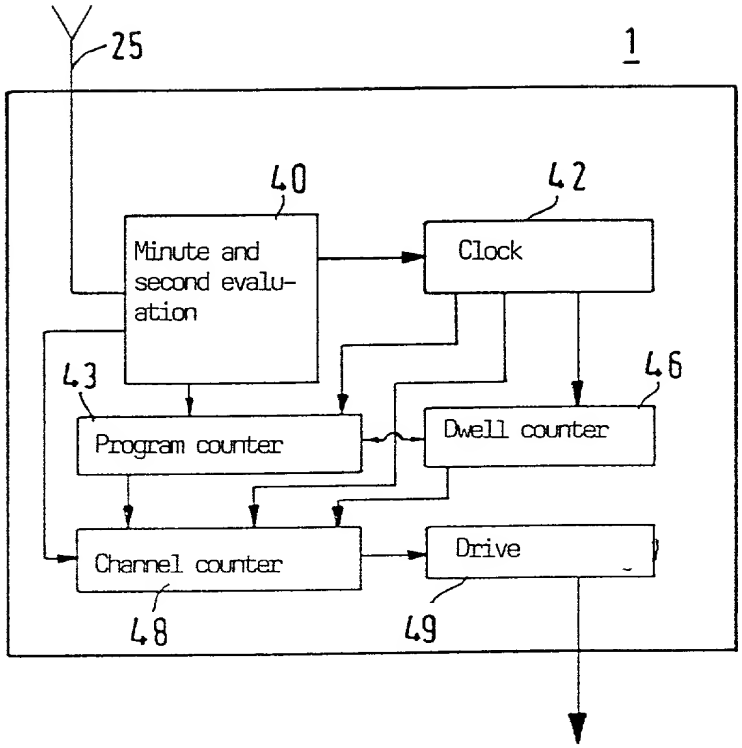

cyclically to 10
20
3
5
2
1
CLK
from 22
Enabled at Sync.-pulse

FIG.4

FIG.5


25
1
40
42
Minute and second evaluation
Clock
43
46
Program counter
Dwell counter
Channel counter
Drive
48
49
To channel switch 10

COMBINED DECLARATION FOR PATENT APPLICATION AND POWER OF ATTORNEY Includes Reference to PCT International Applications	Attorney's Docket No.4478-6PUS

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

Transmitter-Receiver for Data, Signals, System for Transmitting Data Signals, Device for Assembly in a Transmitter-Receiver and Synchronization Method

the specification of which (check only one item below)

[ ] is attached hereto

[ ] was filed as United States application

Serial No. _

on

and was amended

on _ (if applicable).

[x] was filed as PCT international application

Number PCT/EP99/07849

on 15 October 1999

and was amended under PCT Article 19

on (if applicable) _____.

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the patentability of the application in accordance with Title 37, Code of Federal Regulations, §1.56(a).

I hereby claim foreign priority benefits under Title 35, United States Code, §119 of any foreign application(s) for patent or inventor's certificate or of any PCT international application(s) designating at least one country other than the United States of America listed below and have also identified below any foreign application(s) for patent or inventor's certificate or any PCT international application(s) designating at least one country other than the United States of America filed by me on the same subject matter having a filing date before that of the application(s) of which priority is claimed.

PRIOR FOREIGN/PCT APPLICATIONS AND ANY PRIORITY CLAIMS UNDER 35 U.S.C. 119:

Country (if PCT, indicate "PCT")	Application Number	Date of Filing (day, month, year)	Priority Claimed Under 35 U.S.C. 119	
Germany	198 47 665.5	15 October 1998	[x] YES	[ ] NO
PCT	PCT/EP99/07849	15 October 1999	[x] YES	[ ] NO
			[ ] YES	[ ] NO
			[ ] YES	[ ] NO
			[ ] YES	[ ] NO
			[ ] YES	[ ] NO

Combined Declaration for Patent Application and Power of Attorney (Continued)
(Includes Reference to PCT International Applications)

Attorney's Docket
4478-6PUS

I hereby claim the benefit under Title 35, United States Code, §120 of any United States application(s) or PCT international application(s) designating the United States of America that is/are listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in that/those prior application(s) in the manner provided by the first paragraph of Title 35, United States Code, §112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, §1.56(a) which occurred between the filing date of the prior application(s) and the national or PCT international filing date of this application:

PRIOR U.S. APPLICATIONS OR PCT INTERNATIONAL APPLICATIONS DESIGNATING THE U.S. FOR BENEFIT UNDER 35 U.S.C. 120:

U.S. APPLICATIONS			STATUS (*check one*)		
U.S. APPLICATION NUMBER		U.S. FILING DATE	PATENTED	PENDING	ABANDONED
PCT APPLICATIONS DESIGNATING THE U.S.					
PCT APPLICATION NO.	PCT FILING DATE	U.S. SERIAL NUMBERS ASSIGNED (*if any*)			
PCT/EP99/07849	15 October 1999			x	

POWER OF ATTORNEY: As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith (*List name and registration number*)

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Combined Declaration for Patent Application and Power of Attorney (Continued)
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Attorney's Docket
4478-6PUS

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		55 566 Ziplate		

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under §1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

SIGNATURE OF INVENTOR 201	SIGNATURE OF INVENTOR 202	SIGNATURE OF INVENTOR 203
DATE 19.06.2001	DATE	DATE

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